Summer 2 Reflective Report - Leadership in Action and Final Reflection

Spending six weeks of the summer away from home in a country where not only did I not know anyone but where I don't speak the language would have sounded so terrifying to me even just 2 years ago. Despite all this, I had such a positive experience this summer working on my LIA in Belgium, living in and learning about a different culture, getting to witness the inner workings of an internationally collaborative project, and gaining independence and confidence in myself and my abilities as a young leader. I credit the ability to adapt to this new environment and make the most of an incredible opportunity such as this, to the Laidlaw leadership program.

I spent the most amazing summer in the small city of Mons in the south of Belgium working with the MOF4AIR project in UMONs. This MOF4AIR, '**M**etal **O**rganic **F**rameworks for carbon dioxide **A**dsorption processes in power production and energy **I**ntensive indust**R**ies', project is part of the European Union's Horizon 2020 research and innovation program, involving 14 different collaborators in 8 countries across Europe and further afield, in South Korea. The project deals with the entire process of developing high performance metal organic frameworks, MOFs, for carbon capture, and then applying them in technology to reduce the carbon emissions of CO_2 intensive industries. The objective of the part of the project taken on by UMONs is to fine-tune the adsorption processes for high performance MOFs. The entire collaborative project is coordinated by Prof Guy De Weireld of the UMONs, and it was through reaching out to him that I was able to get involved in such an exciting and important project.

At the time I was working with the project it was in the testing stage, where the parameters of the standard test for the MOFs' carbon capture ability were to be defined. This involves testing the adsorption of different CO_2 gas concentrations on different MOFs and then seeing if the material can be regenerated at high temperatures. The objective of my LIA was to optimise the Vacuum Pressure Swing Absorption, VPSA, cycle for the testing process. As these tests are primarily engineering tasks my role was to offer a unique perspective on these engineering endeavours as a chemistry student. The MOF materials that were being tested for their carbon capture abilities are very familiar to me as I worked with them in my first summer of research, which is one of the reasons I first heard about and became interested in the MOF4AIR project.

It was so exciting to work on a project that has such real world applications as the materials being tested are to be used in industries all over Europe to reduce the carbon emissions of fossil fuel intensive plants, such as oil refineries and cement factories. I feel very passionately about the climate

crisis that we are all living through and it was so fulfilling to be able to actually do something that will actively reduce the rising greenhouse gas emissions that are causing climate change.

In the initial plan of the project this summer the testing of the MOFs was to be done on a pilot apparatus to test large volumes of the materials on different pressures and concentrations of carbon dioxide. However due to the unfortunate events of the past few years, including the global pandemic and the war in Ukraine, there were considerable delays in the timeline of the MOF4AIR project. This meant that the pilot testing apparatus that I was supposed to be optimising was only in the process of being built when I arrived in Mons. This was a huge let down especially as I was only made aware of the extent of the delays when I started at the University of Mons .
I was very disappointed to not be able to carry out the exact LIA project that I had planned but I learned that being able to adapt and overcome hurdles is all part of being a leader. I had to rely heavily on the skills that I had learned and honed during my time with the Laidlaw leadership program. Through using my communication and conflict resolution skills I was able to discuss with both the director of MOF4AIR and his research team about how to change my initial plans and goals while also preserving the direction of my LIA project. I had to adapt the specific weekly milestones and tweek some of the overall objectives, but fortunately I was able to keep the same goal of optimising the pressure testing process for the MOF materials. The project I ended up carrying out was essentially the same except instead of working on the pilot apparatus and advising on what adaptations should be made to this I worked on the small scale tests that would be the basis for the pilot apparatus.

In the first weeks I studied the preliminary adsorption tests that had been carried out on 4 different MOF materials and analysed the properties of each of the materials to determine the best MOF to run the pilot on. I presented these results and my recommendation of the chemically superior material to the director of the pilot tests. From this I was able to work with the technical team to carry out the series of experiments on the selected material to determine the parameters for the pilot apparatus. At the end of the project I presented my findings and recommendations to the director of the MOF4AIR project and his team. Throughout the course of the six weeks I got the opportunity to work with many people from different areas of expertise, from thermodynamics, mechanical engineering, structural engineering, administration, to computer science. It was so enlightening to get to work with such a vast array of people and I learned so much from them all in both a research and leadership sense.

The learning curve in a situation such as this is very steep and I had to quickly adapt to a very different environment to what I was used to. The language barrier was the first hurdle that I encountered while working in a foreign university. Fortunately my Leaving Certificate French had not totally abandoned me and I was able to converse well enough with everyone in the university to let them know what I was there to do and figure out where I was supposed to go. Aswell as this I was lucky in that the research team and MOF4AIR project itself was made up of a very international mix of people whose one common language was English. This was a huge relief as while I had studied French for years and had made a recent effort to refresh my language skills it is still very much a second language and having to explain chemistry in French would have been next to impossible. However I was still living in Belgium and so I was forced to improve my language skills through everyday activities such as shopping and taking public transport. I found this extremely difficult at first especially as I was there on my own so had no one there to share the discomfort with. Having said this, the uncomfortable experience of living alone in a foreign country allowed me to become truly independent and grow as both a person and a leader in my own life. I had to call on many of the skills that I had cultivated during my time with the laidlaw program.

My time working on my LIA has provided me with invaluable knowledge and experience both of the world of internationally collaborative projects and research and of myself and my own leadership style. I got to not only witness firsthand the incredible work that is currently being done to help reduce the levels of carbon dioxide in our atmosphere but I also got to be a part of this research and make a real difference in the fight against climate change, which is something that I really didn't ever think would be possible before graduating. I learned that while I feel uncomfortable in new and unfamiliar environments I am able to overcome that discomfort and utilise what I have learned to make the most of every opportunity I have been lucky enough to be granted thanks to this amazing program.